Remarks

The following comments are provided in support of the claims presented. Applicants respectfully request reconsideration of the claims and entry of the amendments presented herein.

1. Restriction Requirement

The Office has required a restriction between the two inventions as recited in the grouping of claims below:

Group I. Claims 1-10, drawn to a method for manufacturing a semiconductor device, classified in class 216, subclass 99.

Group II. Claims 11-18, drawn to an etch composition, classified in class 252, subclass 79.1.

In a telephone conversation with Applicants' attorney, John Hohimer, on February 6, 2003 a provisional election with traverse was made to pursue the invention of Group I, Claims 1-10.

Applicants herein affirm this election to pursue the invention of Group I, Claims 1-10.

2. § 112 Rejection

Claim 7 has been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as their invention. In the § 112 rejection, the Office cites the phrases " 'semiconductor grade' hydrofluoric acid" and " 'semiconductor grade' sulfuric acid" as being subjective, vague and indefinite.

Applicants respectfully submit that the term 'semiconductor grade' as used in Claim 7 is definite since this is a term of art that is widely used in the semiconductor industry to which Applicants' invention pertains. Applicants' disclosure has defined the term "semiconductor grade" on page 3, lines 13-19 as being of a higher level of purity than "technical grade" and as being of a purity that is "preferred when

fabricating semiconductor devices to improve the manufacturing yield and reliability." Additionally, the reference "Reidel-de Haen Electronic Chemicals of Semiconductor Grade," (www.sigmaaldrich.com/saws.nsf/Pages/fl_newproducts_sp3?OpenDocument) pp. 1-4, November 28, 2001 provided with Applicants' Information Disclosure Statement shows that the term "semiconductor grade" is used by chemical suppliers to the semiconductor industry to specify the purity level of many different electronic chemicals including hydrofluoric acid and sulfuric acid which can be used to fabricate semiconductor devices including integrated circuits. Finally, a search of the USPTO Patent Full-Text and Image Database provided herewith shows 40 issued patents which have the term "semiconductor grade" recited in the claims. In view of the definition of the term "semiconductor grade" in Applicants' disclosure, the usage of this term by chemical suppliers to the microelectronics industry, and the usage of this term in the claims of numerous U.S. patents, Applicants urge that the term "semiconductor grade" is definite and particularly points out and distinctly claims the subject matter which Applicants regard as their invention. Reconsideration of the § 112 rejection of Claim 7 is respectfully requested.

3. § 102 Rejection

Claims 1 and 5-7 have been rejected by the Office under 35 U.S.C. § 102(b) as being anticipated by Lin et al (US 6,123,865).

Applicants have herein amended Claim 1 to recite that the etching solution comprises hydrofluoric acid (HF) and sulfuric acid (H_2SO_4) "in a ratio HF:H_2SO_4 ranging from 1:1 to 3:1." Support for this amendment to Claim 1 can be found in originally-submitted Claim 10 which has now been cancelled herein.

Applicants respectfully submit that the amendment to Claim 1 overcomes the § 102 rejection of Claims 1 and 5-7 since Lin et al disclose only ratios of HF:H_2SO_4 which are in the range of 1:3 to 1:20 (see Tables 1 and 2; col. 2, line 58; col. 3, line 25) which is outside the range recited in amended Claim 1.

Attached hereto is a marked-up version of the amendments made to the claims and specification herein. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

4. § 103 Rejections

A. Claims 2-4 have been rejected under 35 U.S.C. § 103(a) as being obvious over Lin et al in view of Gennissen (Sacrificial Oxide Etching Compatible with Aluminum Metallization, Proceedings of the 1997 International Conference on Solid-State Sensors and Actuators, Transducers '97, pp. 225-228, 1997).

Claim 1 has been amended herein to recite that the etching solution comprises hydrofluoric acid (HF) and sulfuric acid (H_2SO_4) "in a ratio HF:H_2SO_4 ranging from 1:1 to 3:1." Neither Lin et al or Gennissen teach or suggest etching using HF and H_2SO_4 in the range recited in amended Claim 1. Therefore, Applicants urge that it would be unobvious to one skilled in the art to form the invention recited in Claims 2-4 based on the combination of Lin et al and Gennissen.

Applicants further submit Lin et al and Gennissen teach to the contrary so that a valid *prima facie* case of obviousness cannot be formed by combining these two references. Lin et al teach a method for etching films including aluminum (see col. 2, lines 36-41; claims 3 and 12); whereas Gennissen teach against etching of aluminum by requiring that the etching solution be capable of "sacrificial oxide etching with very high selectivity to aluminum metallization" (see Summary). Additional teaching in Gennissen against the etching of aluminum can be found in the last paragraph in the left-hand column of page 227 where Gennissen states:

> The unprotected aluminum bondpads on the accelerometer were not visibly attacked during the 6 min. sacrificial etch which was needed to release the structure.

Lin et al further teach against immersion etching in favor of spray etching (see col. 1, lines 31-42); whereas Gennissen utilize immersion etching (see last paragraph in left-hand column on page 227: "After the 6 min etch the samples were taken out of the etch mixture..."). Lin et al also teach the use of water as an essential part of the

etching process, both immediately prior to etching and for rinsing after etching (see col. 2, lines 12-17; Tables 1 and 2; claims 1 and 7). Gennissen teach against the use of water (see first paragraph on right-side column on page 227: "Rinsing in water is not possible as this would lead to rapid attack of the aluminum." See also, last sentence in Conclusions on page 228: "The samples should not be rinsed in water, since water addition to the HF will result in rapid attack of the aluminum interconnect due to a higher H_3O^+ concentration."). The contrary teaching in Lin et al and Gennissen provides evidence for the *prima facie* unobviousness of Applicants' claimed invention in view of this combination set forth by the Office. Applicants respectfully submit that, in view of the contrary teachings in Lin et al and Gennissen as set forth above, one skilled in the art would not be motivated to combine these two references to form Applicants' claimed invention as recited in Claims 2-4.

B. Claims 8-10 have been rejected under 35 U.S.C. § 103(a) as being obvious over Lin et al in view of Cripe (US 5,851,928).

Applicants have herein cancelled Claim 10.

Applicants respectfully submit that amended Claim 1 which incorporates the limitations of cancelled Claim 10 is unobvious over the combination of Cripe and Lin et al since utilizing the concentrations of HF and H_2SO_4 from Cripe in Lin et al as suggested by the Office would not result in "a ratio of HF:H_2SO_4 ranging from 1:1 to 3: 1" as recited in amended Claim 1 since Lin et al disclose only ratios of HF:H_2SO_4 in the range of 1:3 to 1:20 (see Tables 1 and 2; col. 2, line 58; col. 3, line 25) which is outside the range recited in amended Claim 1, and since Lin et al do not teach or suggest any other values for the ratios of HF:H_2SO_4.

Additionally, Cripe disclose non-uniform etching of the surface of a semiconductor substrate as defined by an etch mask, with the non-uniform etching being performed using a mixture of hydrofluoric acid, nitric acid, phosphoric acid, sulfuric acid, and a wetting agent (claim 1; col. 3, lines 53-55). The etch concentrations of H_2SO_4 at 96% and HF at 49% cited by the Office in col. 4, lines 5-10

of Cripe relate to etching completely through the semiconductor substrate at a high etch rate of 25-100 microns per minute (see col. 4, lines 34-38).

Applicants respectfully submit that Cripe teaches away from Lin et al who require uniform etching of a blanket film disposed on a substrate without any disclosed masking and without any disclosed etching of the substrate (col. 1, lines 6-9 and 53-67; col. 2, lines 1-11). Such teaching away provides evidence for the *prima facie* unobviousness of amended Claim 1 and Claims 8-9 stemming therefrom.

Lin et al also disclose that the uniform etching of films on the substrate takes place at a much slower rate of 1-2 microns per minute or less (see col. 2, lines 52-67 - 5,000Å thick BSG layer etched in 70-180 seconds for etch rate of < 0.5 microns/ minute; col. 3, lines 14-38 - 5,000Å thick BSG layer etched in 30-80 seconds for etch rate of ≤ 1 micron/minute; and Table 3 etch rates for examples of 1.9 - 2 microns/ minute). Applicants respectfully submit that the motivation set forth by the Office "because it has a desire etch rate for semiconductor material" would not lead one skilled in the art to adopt the HF and H_2SO_4 concentrations of Cripe for use in the etch process of Lin et al since the HF and H_2SO_4 concentrations of Cripe relate to etching of the substrate at at a high etch rate of 25-100 microns per minute (see col. 4, lines 34-38) and there would be no expectation of success that the HF and H_2SO_4 concentrations of Cripe would be applicable to etching of blanket films on a substrate as taught by Lin et al with the etch rate being more than an order of magnitude smaller.

Additionally, the stated goal of Lin et al is to improve etch uniformity (see col. 1, line 65 through col. 2, line 11; and col. 3, line 63 through col. 4, line 3), so that one skilled in the art would not be motivated to increase the etch rate by more than an order of magnitude using the HF and H_2SO_4 concentrations of Cripe since Applicants urge that this would be contrary to the goal of Lin et al to obtain uniformity in etching of films disposed on a substrate. Therefore, Applicants respectfully submit that the Office has not provided the motivation required to

establish a *prima facie* case of obviousness based on the combination of Cripe and Lin et al. Reconsideration of the § 103 rejection of Claims 8 and 9 is respectfully requested.

Conclusion

Applicants have responded to each and every rejection and objection, and urge that the Application is in condition for allowance. A favorable reconsideration and entry of the amendments presented herein is earnestly solicited.

Respectfully submitted,

Dated: March 25, 2003

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CERTIFICATE OF FACSIMILE

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being sent by Facsimile on the date shown below to the PTO by Fax at (703) 872-9310.

John P. Hohimer
(Type or print name of person faxing paper)

Dated: 3/25/03

(Signature of person faxing paper)

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claim 10 has been cancelled.

Claim 1 has been amended as follows:

1. (Once Amended) A method for manufacturing a semiconductor device using an oxide sacrificial material, comprising the step of etching the oxide sacrificial material using an etching solution comprising hydrofluoric acid (HF) and sulfuric acid (H_2SO_4) in a ratio HF:H_2SO_4 ranging from 1:1 to 3:1.

Serial # 10/010,850
Group 1765

USPTO PATENT FULL-TEXT AND IMAGE DATABASE

Searching 1976 to present...

Results of Search in 1976 to present db for:
ACLM/"semiconductor grade": 40 patents.
Hits 1 through 40 out of 40

Jump To

Refine Search ACLM/"semiconductor grade"

	PAT. NO.	Title
1	6,251,182	Susceptor for float-zone apparatus
2	5,948,300	Process tube with in-situ gas preheating
3	5,868,924	Water purifier
4	5,851,303	Method for removing metal surface contaminants from silicon
5	5,614,018	Integrated circuit capacitors and process for making the same
6	5,455,430	Photovoltaic device having a semiconductor grade silicon layer formed on a metallurgical grade substrate
7	5,431,127	Process for producing semiconductor spheres
8	5,399,263	Water purifier
9	5,397,468	Water purifier cartridge coupling
10	5,373,807	Apparatus for growing multiple single crystals
11	5,361,128	Method for analyzing irregular shaped chunked silicon for contaminates
12	H1,221	High speed, small diameter disk storage system
13	5,165,548	Rotary silicon screen
14	5,123,636	Low-contaminate work surface for processing semiconductor grade silicon
15	5,118,485	Recovery of lower-boiling silanes in a CVD process
16	5,108,720	Float zone processing of particulate silicon
17	5,080,730	Implantation profile control with surface sputtering
18	5,061,348	Sulfuric acid reprocessor with continuous purge of second distillation vessel
19	5,041,308	Method of coating silicon particles
20	5,032,218	Sulfuric acid reprocessor
21	4,980,032	Distillation method and apparatus for reprocessing sulfuric acid

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22 4,979,015 Insulated substrate for flip-chip integrated circuit device
23 4,911,896 Fused quartz member for use in semiconductor manufacture
24 4,878,106 Semiconductor circuit packages for use in high power applications and method of making the same
25 4,820,587 Polysilicon produced by a fluid bed process
26 4,613,489 Process for the disproportionation of chlorosilanes
27 RE32,193 Composite magnetic recording disk
28 4,528,530 Low temperature electronic package having a superconductive interposer for interconnecting strip type circuits
29 4,487,162 Magnetoplasmadynamic apparatus for the separation and deposition of materials
30 4,427,509 Light driven photocatalytic process
31 4,427,508 Light driven photocatalytic process
32 4,379,181 Method for plasma deposition of amorphous materials
33 4,298,423 Method of purifying silicon
34 4,195,067 Process for the production of refined metallurgical silicon
35 4,193,975 Process for the production of improved refined metallurgical silicon
36 4,170,667 Process for manufacturing pure polycrystalline silicon
37 4,140,548 MOS Semiconductor process utilizing a two-layer oxide forming technique
38 4,124,410 Silicon solar cells with low-cost substrates
39 4,070,444 Low cost, high volume silicon purification process
40 3,969,163 Vapor deposition method of forming low cost semiconductor solar cells including reconstitution of the reacted gases

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